Extensive Cereal farming, steppes and dry grasslands in Spain : ecosystems on the brink

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Abstract

Extensive cereal farming, dry grasslands and steppes occupy large areas of Spain (c.a. 4,500,000 ha) and they have a great natural value due to animal and plant species living in them. The origin and maintenance of open lands are so closely linked to traditional exploitation that the future of many of their most typical species is tied to that of man-induced spatial diversity. Thus, socioeconomic changes in rural areas during last decades have already modified the dynamics and structure of these landscapes. The short- and medium-term prospects for the agrarian sector include the potential for dramatic changes to them. The replacement of traditional management by intensive exploitation, tree plantations or even the complete abandonment of farming activities, would have a fatal impact on the plant and animal components of the ecosystem and their interactions. In this context, any conservation policy must safeguard these landscapes by maintaining a sufficiently large area and diversity of agrarian substrata.

Extensive cereal farming, steppes and dry-grasslands (pseudo-steppes hereafter) cover large areas of Spain (Suárez 1994, Suárez et al. 1992, 1995). Steppes with natural vegetation (in remaining tracts of at least 300 ha) have been calculated to cover 570,000 ha, while the total surface area of pseudo-steppes is approximately 4.5 million ha. Some estimates, however, raise this to 10 million ha. Natural-vegetation steppes are comprised of a series of distinct plant communities, some of which are included in the Habitats Directive under the 'Salt and gypsum steppes', 'Pre-steppic sclerophyllous scrubs' or 'Dry grasslands and steppes' headings. All of these communities can be found in isolation, but more often they are an integral part of the farm landscapes discussed here.

Spanish pseudosteppes are highly valuable due to the number of species whose populations rely almost exclusively on them (Suárez et al. 1992). Many of their plant species are endemic (e.g. *Gypsofila spp., Thymus loscosii, Boleum asperum, Vella pseudocytisus subsp. pseudocytisus* and *paui),* and they also host relic populations of species whose distribution centres are very distant (e.g. *Krascheninnikovia ceratioides*, widely distributed in Asia and with small populations in Morocco and the Ebro Depression, DGA 1994). Bird communities in Iberian pseudo-steppes are also extremely valuable (Tucker & Heath 1994). They include two species whose populations are vulnerable at world-level (*Otis tarda* and *Falco naumanni*) and another near-threatened *(Tetrax tetrax).* Moreover, 15 out of the 17 most characteristic European steppe bird species are amongst the Species of European Concern (SPECs), and 14 of the former have their biggest populations in Spain. This feature is critical, as one is considered endangered, 5 have declining populations, 6 are vulnerable and one is defined as rare (Tucker & Heath 1994).

The natural value of pseudo-steppes is closely linked to their historic use. Open landscapes, while natural on the Iberian Peninsula, probably occupied smaller areas prior to human deforestation for agriculture and livestock husbandry (Costa et al. 1990). The gradually increasing area of pseudo-steppes and the farming systems developed in them permitted the adaptation of animal and plant communities, thus giving rise to high-diversity ecosystems (Aschmann 1973). Traditional land management was based on cereal and legume cropping combined with one- to eight-year fallow periods. Pasture and scrub occupying shallow soils and slopes were traditionally preserved, and intermingled with arable land for sheep grazing, the same use given to fallow land and stubble. Under this management, uncultivated land acted as a refuge for many species, while the increase in open areas and the ensuing spatial diversification led to the increase in species adapted to these landscapes.

The close relation between exploitation and conservation is the major threat to pseudo-steppes. Socio-economic changes associated with the rural crisis (especially since 1960) started the decline of these landscapes and their animal and plant populations (González-Bernáldez 1991, Peco et al. 1993). The low productivity of many farms, the increase in transport facilities and the demand for an urban workforce led to massive emigration and the alteration of traditional management systems. Similar changes (but on a larger scale) due to the universalization of the economy and the Common Agriculture Policy crisis can be expected in the short term.

Changes in management have followed an 'intensify or abandon' rule, with effects at different spatial scales. Large areas have become completely depopulated and all cultivation suspended, while other areas have multiplied their productivity through the use of more powerful machinery and agro-chemicals, as well as to farm enlargement. The same process has happened at much smaller scales leading to the partial depopulation of villages and the mixture of intensive farming and abandonment in most agrarian landscapes (Peco et al. 1993). Thus, cultivation has been modernized and restricted to the more productive soils (e.g. valley floors), now surrounded by unploughed fields. Livestock has become partially enclosed and supplemented with fodder, and traditional herd shifting in search of pastures has ceased. In spite of these measures, profitability remains very low in many areas: mean cereal crops average 2,500 kg/ha and their interannual variability due to weather is very high. Stocking rates are usually lower than 1 sheep/ha, although 2-3 sheep/ha is achieved in some areas thanks to supplementary fodder.

Such changes have led to a constant decline in both the area of fallow land

and the diversity of land uses. As a direct consequence, the potential area for steppe species has diminished, which may be the reason for the present 'vulnerable', 'declining' or 'endangered' status of many of them (Tucker & Heath 1994, DGA 1994). Other factors such as the increase in pesticide use may have also had negative effects on animal and plant populations.

At present, low profitability is combining with an ageing population and small farm sizes to destabilise the system, and the 'intensify or abandon' rule will soon modify large areas of the territory. The maintenance of present farms is unviable as it is mostly dependent on subsides from the European Union (Peco et al. 1993). The crisis in the agricultural product-prices policy and the uncertainty about its future make any landowner death or retirement lead to the abandonment of the farming use of a part of the territory. Thus, CAP subsides and other land-use policies can lead to dramatic changes in farm areas, as happened during 1990-91 and 1991-92 with subsides for sunflower crops (663,000ha and 1,456,000 ha respectively vs. 2,000 ha in 1989-90). Afforestation programmes implemented under the R. 2089/92/CEE are a good example of this, and are probably the biggest threat to pseudo-steppes as they can affect large areas and many landowners see them as a means of getting income from their proprieties.

The consequences of such changes are difficult to evaluate, but the losses of area and diversity of agrarian substrata may have direct effects on plant and animal populations. New tree plantations or irrigation over large areas can lead to the extinction of some species (e.g. *Puccinellia pungens* (Poaceae) or *Eucypris aragonica* (Ostracoda) endemic to salt ponds) as well as to the decline in potential areas for all steppe organisms. The spatial simplification of plant communities in landscapes can also be detrimental to animal species as many of them rely on the combination of different agrarian substrata (Tellería et al. 1988).

The indirect consequences of changes in land use may be even greater, as alterations to ecological processes can reinforce the declining trend in steppe species. This is a very difficult point to analyze, but empirical data show that grazing cessation, the increase in some species due to changes in farming methods and the alteration of physical processes can have serious effects on typical open land species. An analysis of other processes would undoubtedly generate a longer list of threatening side effects associated with land-use changes.

The elimination of livestock changes competitive relations among plant species and facilitates succession towards communities with bigger plant development. Such successional stages are characterized by the dominance of woody species, a decrease in small-scale plant diversity and the displacement of species associated with disturbance (Grime 1979, Tilman 1988, Peco et al. 1993). Many endemic or relic steppe plant species (i.e. *Sysimbrium cavanillesianum, Krascheninnikovia ceratioides*) are somewhat ruderal and their maintenance is associated with some degree of disturbance. Thus, they could be displaced by 'competitive species' following the removal of grazing.

Moreover, livestock is a powerful seed disperser (Sorensen 1986, Malo & Suárez 1995), and it thus may help to maintain plant populations. Long-range seed dispersal may be a key factor controlling diversity in open lands as plant populations seem to be affected by local colonization-extinction processes due to habitat diversity and random events (Kadmon & Shmida 1990). The lack of dispersal has been blamed for the species impoverishment found in some areas following grazing cessation (González-Bernáldez 1991), and the importance of sheep flocks as seed vectors has been postulated for some endemic species (i.e. *Boleum asperum, Vella pseudocytisus*, DGA 1994, F. Domínguez pers. com.)

Succession towards woody plant communities, the establishment of small forests among crops and the abandonment of traditional farming can lead to an increase in opportunist predators. These species may become a major threat to ground-nesting steppe birds. Very high nest predation rates have been found in and around forested plots on pseudo-steppes in Central Spain (Santos & Tellería 1992, J. Herranz, pers. com.). Also, nest predation by foxes and feral dogs has been found to make lark population breeding unviable in one Nature Reserve in southeastern Spain (Suárez et al. 1993).

Finally, the disturbance of watershed levels following irrigation implementation may cause the desiccation of ephemeral ponds (followed by ploughing) or changes to their chemical and seasonality characteristics. As many endemic and relic steppe taxa on the Iberian Peninsula are associated with these environments (i.e. DGA 1994), both alterations may lead to species extinctions.

Due to the above-mentioned determinants, traditional conservation schemes are not directly applicable to these areas. The cost of preserving traditional farming systems over such large areas makes policies based on farm subsides or Protected Areas unsustainable. Also, agro-environmental regulations from the EU may have a low level of acceptance as intensification or tree plantation can be more profitable.

Thus, the preservation of the current surface area of pseudo-steppes cannot be achieved, and conservation strategies should be aimed at maintaining their major characteristics. They should focus on preserving areas that are large enough to ensure the survival of plant and animal populations, but they should also pay special attention to the spatial diversity at different scales of the resulting landscapes. Such a combination of area and spatial diversity should sustain ecological processes. Prior to the design of such strategies, it is urgent to improve our understanding of species refuges, species habitats and the use of different landscape patches, and the processes linking them. All of this knowledge should be a basis for a spatial design in which areas of natural vegetation are kept intermingled with crops and stubble in a somewhat similar fashion to traditional systems. If this were possible, modern intensified exploitations could be valuable for the maintenance of steppe species, and the preservation of pseudo-steppe landscapes would be achievable on economic as well as ecological grounds.

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Résumé

Cultures céréalières extensives, steppes et pâturages xérophytiques en Espagne: écosystèmes en suspens. Les cultures céréalières extensives, les pâturages xérophytiques et les steppes occupent une importante superficie en Espagne (dans son ensemble environ 4,5 millions d' Ha), et possèdent une grande valeur naturelle, conséquence d'une grande richesse en plantes et animaux. L'origine et le maintien de ces milieux ouverts se trouvent étroitement liées à leur utilisation traditionnelle; ainsi la conservation des espèces les plus caractéristiques dépend de la diversité spatiale créée par les aménagements humains. Les changements socio-économiques survenus en milieu rural ces dernières décades ont affecté la structure et la dynamique de ces paysages. Les perspectives à court et moyen terme font craindre des changements encore plus drastiques. L'abandon de l'exploitation traditionnelle pour des systèmes plus intensifs ou la substitution par des cultures arborées, voire l'arrêt complet d'activités agraires, peuvent avoir de graves conséquences sur la faune, la flore et les processus caractéristiques des milieux ouverts. Dans ce contexte, la mise en place d'une politique de conservation passe par la sauvegarde de grandes zones de paysages diversifiés.

ANNEXES

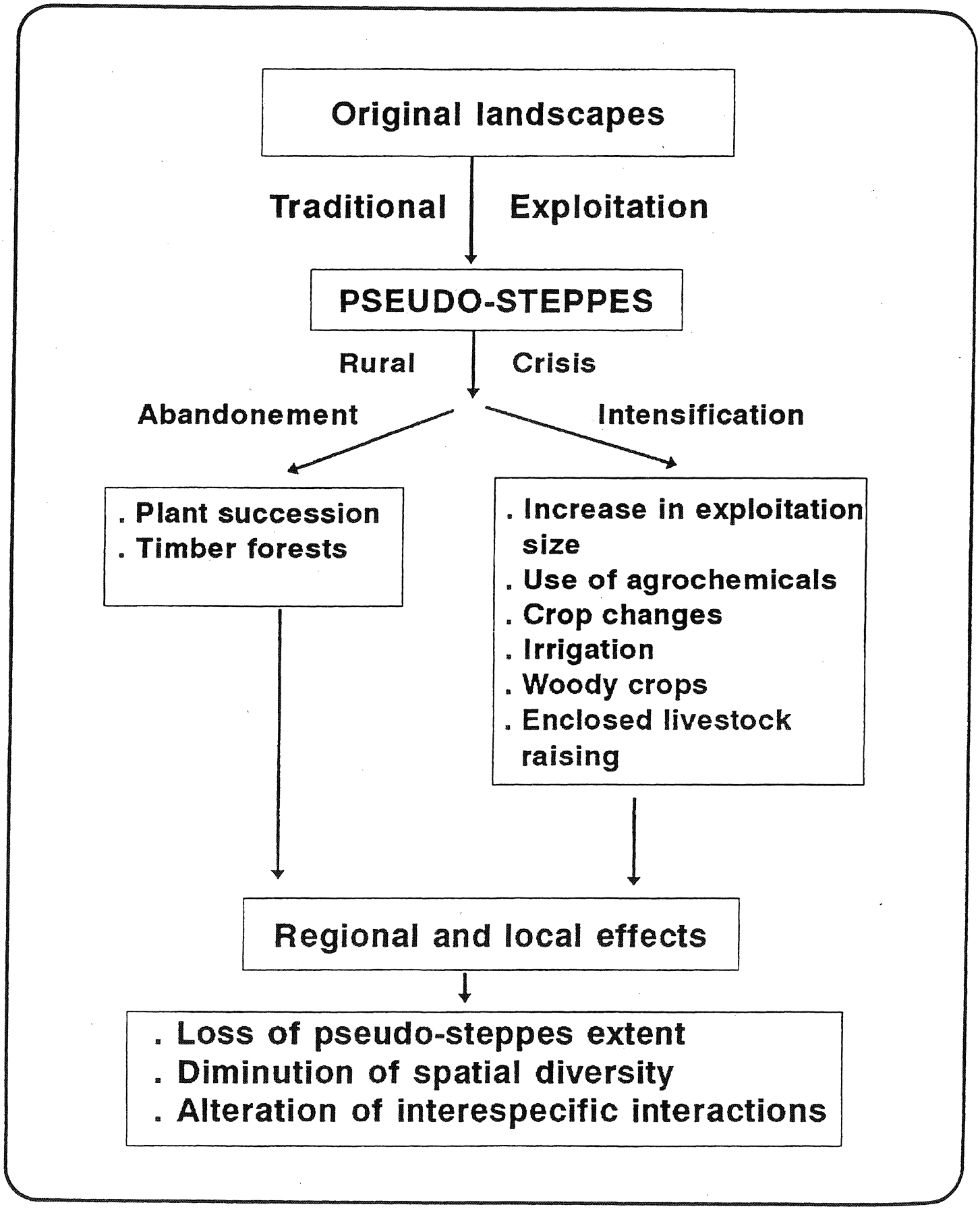
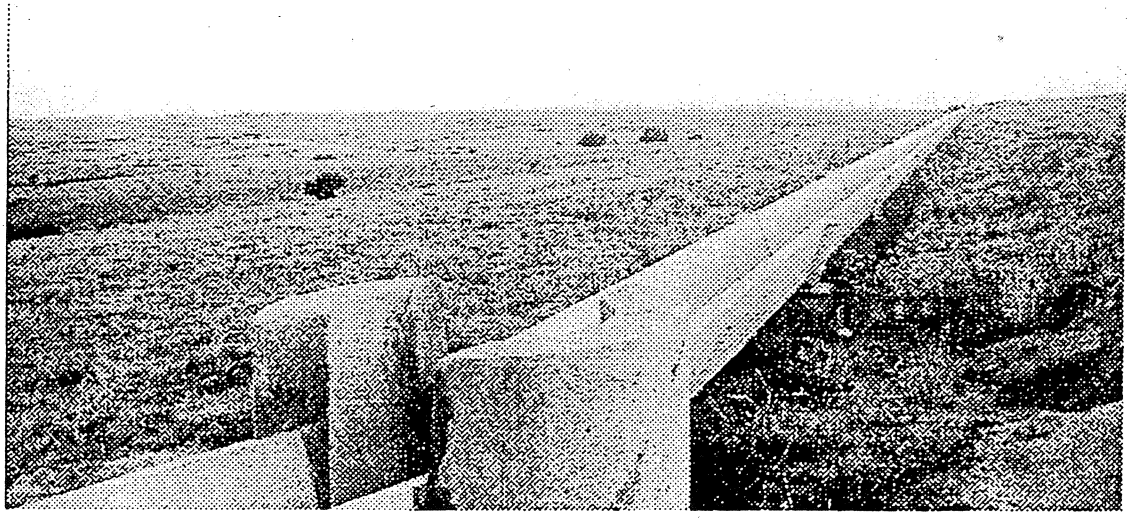


Fig. 1 : Major factors determinig Spanish pseudo-steppes present and future

ANNEXES

Picture 1 : Traditional pseudo-steppe landscapes wre composed by a mixture of natural vegetation and clops

Picture 2 : Lax productivity, cereal clops are not profitable anymore and they are thos abandoned



Picture 3 : Landscapes are changing following the «intensity or abandon» : irrigation projects and intensive livestock raising threat the conservation of dry grasslands